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Morphological Notes.

1. *Juglans cinerea* and *J. nigra* are both possessed of winter buds composed of entire transformed leaves. The buds under consideration are the terminal buds. The scales in the former species (Fig. 1) are somewhat tapering, although thick and broad throughout their entire length. Those of the latter (Fig. 2) are broad at either end, but contracted at the center. In both cases a series of narrow grooves, running parallel from the raised ridge in the middle to the edges on either side, indicate the leaflets of our transformed leaf. This portion, however, is confined to the tip; hence the greater part of these scales must be composed of the common petiole of a compound leaf.



Fig. I



Fig. II

2. The same structure is visible in *Fraxinus quadrangulata*, Mx. In this case the buds are not long, as are those of *Juglans*, but short and conical. The outer scales (Fig. 3) show the same ribbed structure, indicating leaves. In this case we again have scales composed chiefly of the common petioles of compound leaves, but the leaflets still remain attached in a rudimentary condition, as in the case of *Juglans*.



Fig. III

3. In *Negundo aceroides* the scales (Fig. 4, a) are of an ovoid shape, and bear at the tip three small leaflets, which, however, shrivel up and fall off in winter, leaving a scar on each scale at the tip (Fig. 4, b). In this plant, therefore, the scales consist only of the remaining common petiole of a compound leaf. In other members of the genus *Fraxinus*, where indications of leaflets never appear, the scales may be considered as composed only of the common petiole, the leaflet being obsolete.

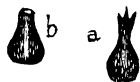


Fig. IV

4. *Sassafras officinale* has scales bearing such plain veins that we may confidently attribute their origin to the blades of leaves.

5. In *Smilax hispida* the petioles remain during winter half surrounding the bud and acting as one of the outer scales of the hibernaculum (Fig. 5). The tendrils, which are transformed stipules, also remain, being attached to the petiole. The remaining scales composing the proper envelopes of the hibernaculum, in this case, may be considered the bases of petioles, much changed in their new capacity.



Fig. V

6. The thorns of *Robinia* are known to be stipules; those of *Gleditschia*, branches; those of some *Astragali*, petioles; those of the Barberry the veins of the leaves. (See Gray Struct. Bot.)

7. A study of the Osage orange, *Maclura aurantiaca*, shows its thorns to be transformed branches. Tiny notches toward the tip often indicate nodes on this branch. At the base, on either side, are two scales, only one of which subtends a bud, the other being empty. These are at the two lower nodes of the metamorphosed branch. On growth of the young bud into a branch it pushes the thorn aside, so that this appears to be axillary to the young branch in the axis of the really empty scale at its side.

8. The spines of *Ribes Cynosbati* are mere outgrowths of the bark, as are also those of the *Smilax* above mentioned, and therefore are of no morphological importance.

9. In *Sambucus Canadensis* the buds consist of short but broad scales which already subtend several axillary buds, as well as aid in protecting the large central bud which is to furnish the main shoot. A single bud, however, which sometimes appears beneath the central bud, seems to have no connection with it, and I can not find that it is subtended by a scale. It however originates in the same tissues with the larger bud, and the connection with it may be traced beneath the bark. Can they, in such cases, be strictly said to be superposed?

10. In *Lindera Benzoin* two branches, superposed in the axils of last year's leaves, each terminate in a leaf bud and have two lateral branches which are flower buds. In spring the lateral buds blossom, and the terminal buds are at liberty to develop into branches, but the upper one generally gets the start, and the other dies. In this way we have extra-axillary branches.

11. The development of the bud scales of the dogwoods in spring is quite interesting. In *Cornus florida* each scale represents the *tip of a leaf*, and in spring it shows its character by developing at the base into a broad petaloid blade, which bears the withered scale at its tip. In this condition the scales serve as an involucre to the condensed cyme (glomerule) within. The closely related *C. Canadensis* has a similar involucre, which, however, never served as scales, being enclosed with the leaves in a subterranean hibernaculum, and having developed from it on the approach of spring. In this it resembles many other herbaceous perennials. The scales which compose the hibernaculum are almost membranaceous, and represent the *entire blades* of leaves. As far as can be observed from a few specimens, the growth of the stem from year to year is sympodial. First a terminal bud

develops into a flowering stem ; after flowering this dies, but at its base two opposite buds have been formed, only one of which develops the following season, and this manner of growth is continued from season to season.

12. In *Viburnum nudum* the bud scales are composed of the bases of leaves, their morphological nature becoming evident by the development of leafy tips or blades in spring.

(Fig. 6, outer scale ; fig. 7, inner scale.)

These leafy tips are formed on the scales of both leaf and mixed buds, but owing to the falling off of the more evident broader scales early in the spring while their blades are still quite small, and their consequent non-preservation in herbaria, the fact is generally overlooked. The development of the base here before the tip of the leaf forms an exception to the usual rule that the development of



Fig. 6



Fig. 7

leaves proceeds from their tips to the base.—AUG. F. FOERSTE, Dayton, Ohio.

Teratological Notes.

1. *A Botrychium with three fertile segments*.—Among the numerous specimens of *B. Lunaria*, Swartz, sent by Mr. S. M. Turner from Afognak Island, Alaska, there is one that has two secondary fertile segments standing on the main fertile segment of the frond. They start from it near its commencement, and are all nearly the same size. All appear fully developed, bearing about the usual number of sporangia.

2. *Ludwigia alternifolia with a broad stem*.—During the past August I found a specimen of this species in which the upper half of the stem was only about one eighth of an inch thick, while in breadth it measured from one-half to an inch. It sent out, at the sides, short flower bearing branches. The plant grew in a swamp, was nearly four feet high, and otherwise thrifty.

3. *Ranunculus repens with flat peduncles*.—During the past summer I found several examples of this species in which the peduncle was flat, and bearing on its top an irregular mass of petals.

4. *Two Oaks grown together*.—Within three miles of Mt. Carmel (Ill.) there is an Oak (*Q. palustris*, Du Roi), which commences with two roots ; these are so close together and intergrown as to appear as one at the surface of the ground. The